

AML TECHNICAL SPECIFICATIONS	
TABLE OF CONTENTS	
	Revision Date
General Provisions	7-2013
Access Gate	
Barrier- Bale & Plywood	
Barrier- Rail / Pipe Steel Panel Wall	
Barrier- Concrete	
Bituminous Repair	
Burning Refuse	
Concrete	
Concrete Block- Interlocking Mat	7-2013
Concrete Block- Tied Mat	11-2013
Concrete Headwalls	
Crushed Aggregate And Channel Lining	
Ditches	12-2013
Drop Box / Junction Boxes	
Earthwork	
Equipment	
Erosion Control Blanket	12-2013
Fence	
Filter Fabric	
Flume	
Gabions	
Gate Valves	
Geogrid	
Grout Products	
Guardrails	
Hazardous Material	
Highwall- Slope Rockfall Barrier Fence	
Highwall- Slope Rockfall Netting Light Duty	
Highwall-Slope Rockfall Netting Heavy Duty	
Industrial Mining Debris Removal	
Mobilization/Demobilization	
MSC Non-reinforced Concrete Block Walls	Renamed
Non-reinforced Concrete Block Walls	10-2013
Pile And Lagging Retaining Wall	
Pipe	12-2013
Pneumatic Backstowing	
Polyurethane Foam	
Portal Closure	
Reinforced Concrete Pilings And Cap	
Revegetation	
Sheet / Chimney Drains	

Sheet Piling	New 12-2013
Shotcrete Application	
Silt Control	
Site Preparation	
Soil Reinforcing Tubes	
Steel	
Stream Channel Protection & Restoration	
Structure Removal/Replacement	
Subsidence Closure	
Subsurface Drains	12-2013
Temporary Access Bridge	
Temporary Low Water Crossing	12-2013
Traffic Control	
Utility Relocation	
Water Treatment And Disposal	
Water Wheel Powered Doser	
Welded Wire Reinforced Soil Wall	
Wetland Compost	12-2013

13. COAL REMOVAL

No coal, refuse, or other mineral resources shall be removed from either the project area or from the construction & waste areas in conjunction with this contract.

14. PRE-BID CONFERENCE

A Pre-Bid Conference will be held as specified by the bid documents. The Pre-Bid Conference should be attended by representatives of the COMMONWEALTH (i.e. representatives of AML) and Contractors interested in bidding on the Project. **No individual site visits by the Contractor(s) or representatives of the COMMONWEALTH shall be held.**

15. METHOD OF BIDDING

The Bidder must use the bidding documents furnished by the COMMONWEALTH. All data and other information requested must be supplied. The bidder must submit unit price bids on all items contained on the Bid Schedule, regardless of whether the individual items of work are to be let by "Unit Price", "Lump Sum", "Actual Cost", or "Plan Quantities".

The submission of a bid will be construed as evidence that a site visit and examination have been made, that the bidder is thoroughly familiar with, understands, and agrees to all terms and intents of the Contract Documents, and that any conflicts within the documents or between the documents and other written instructions or verbal statements have been resolved to the satisfaction of the bidder. Claims for labor, equipment, materials, or other costs required due to difficulties which could have been foreseen had an adequate examination of the site been made, the Contract Documents read thoroughly and clarification sought will not be recognized.

16. AWARD OF CONTRACT

Award of Contract will be made as determined by the Finance and Administration Cabinet. The unit prices will control the extensions and totals. Any obvious case of unbalanced bidding will be considered sufficient grounds for rejection of the entire bid. The COMMONWEALTH reserves the right to reject any and all bids if it is deemed to be in the best interest of the COMMONWEALTH.

17. PRE-CONSTRUCTION CONFERENCE

Following the signing of the Contract Documents and prior to the actual beginning of the construction, a pre-construction conference will be held. Representatives of the DAML, the CONTRACTOR, including any SUBCONTRACTORS, the Finance and Administration Cabinet, as well as other interested agencies and parties may be present to discuss the time and sequence for construction, methods and plans of operations, payment and other relevant questions. The time and locations of this meeting will be the responsibility of the DAML in consultation with the other parties.

occurs at the direction of the ENGINEER, payment will be made at the bid unit price for such item or in a lump sum as agreed to by both parties.

10. PROPERTY OWNER CONSIDERATION

(Revised 7-2013)

Authority to enter and reclaim private property is obtained by written consent of the owner and is pursuant to Title IV of the Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1231, and KRS 350.150. The COMMONWEALTH, in complying with these provisions, does not obtain title or rights to any property within the project area. All rights to property and existing materials within the project area will therefore remain the property of the owner.

Materials having a salvage value (coal, oil, gas, precious metals, timber, topsoil, etc.) shall remain the property of the owner. Salvageable material (excluding coal, refuse, & other mineral resources) rejected by the owner shall become the responsibility of the CONTRACTOR to dispose of in a proper manner subject to the approval of the ENGINEER.

During the construction process it may happen that property monuments or property fence may be disturbed. Prior to disturbance, the CONTRACTOR shall give DAML at least 2-week notice to allow DAML to reference said monument(s). If the CONTRACTOR disturbs the monument(s) without providing a 2-week notice to DAML, then the CONTRACTOR shall be responsible for having the monuments reestablished by a Professional Land Surveyor licensed/registered in the Commonwealth of Kentucky at the CONTRACTOR's expense. DAML referenced monuments will be reestablished after construction; however, DAML will not certify the monuments as an official property corner.

11. ALTERNATIVE / EQUIVALENT PRODUCTS & MATERIALS

The use of alternative/equivalent products, materials, and systems shall be approved in writing by the DAML design engineer in conjunction with the DAML construction oversight engineer prior to ordering or using the product/materials. The CONTRACTOR must submit a written request to use alternative/equivalent products, materials, and systems along with all certifications, testing results, specifications, and any other information required by DAML. The ENGINEER may require additional testing. Such testing shall be paid for by the CONTRACTOR. In certain instances the ENGINEER may require the CONTRACTOR to guarantee the product for a period of time to be stated in writing and incorporated into the contract. DAML will provide written approval or disapproval.

The use of alternative products, materials, systems may require alterations to the design plans by a professional engineer (licensed & registered in Kentucky) employed by the product supplier or CONTRACTOR. These revised plans shall be reviewed and approved by the ENGINEER.

12. BLASTING RESTRICTIONS

No blasting shall be permitted without prior approval. In the event blasting is proposed the CONTRACTOR shall prepare documentation outlining the blasting plan and requesting approval. The request must be made and approved prior to any blasting.

CONCRETE BLOCK - INTERLOCKING MAT

1. SCOPE

The work shall consist of furnishing and installing interlocking cellular concrete blocks where shown on the Drawings or as otherwise directed by the ENGINEER. Block style must be pre-approved by the ENGINEER prior to being brought to the site.

2. MATERIALS

2.1. Concrete: Shall be Class A concrete conforming to the "Concrete" technical specification.

2.2. Cellular Concrete Blocks: The cellular concrete blocks shall be interlocking components dimensioned within a 16 inch module. Each component shall lock into the minimum of three adjacent components in a manner which inhibits horizontal movement. The blocks shall have a thickness of either 4 inches or 6 inches and shall be specified on the drawings.

The unit weight of the concrete used shall not be less than 125 pounds per cubic foot on an oven dried basis. Pre-cast concrete and machine made blocks shall have a compressive strength of 4,000 psi minimum. Machine made concrete blocks strength shall be determined by testing random cubes, cut from the body of the block.

The assembled cellular block system shall have voids at the ground/block interface of a minimum 16% and shall provide, when required, adequate channels between cells below the top level of the blocks for the migration of vegetation from cell to cell if called for on the Drawings. The voids may also be filled with stone as specified or as directed by the ENGINEER.

The assembled cellular concrete block system shall flex to a minimum of 3 feet radius in any two directions a minimum of 60° apart without separation of the blocks at the base. The interlock must remain securely fastened at this radius. Blocks shall interlock on all sides.

2.3. Aggregate: Shall conform to the "Crushed Aggregate and Channel Lining" technical specification.

3. CONSTRUCTION

The slope must be stable independent of the erosion system. Filled slopes must be compacted to minimum 90% proctor. Before placing the cellular concrete block system on the underlying geotextile as specified on the Drawings, the slope shall be inspected to insure that it is free from obstructions, such as tree roots, projecting stones or foreign matter, voids or soft areas should be filled with the suitable material and well compacted. Although some variation in contour will be permitted, no sudden changes in level can be accepted. The maximum difference in level between any cuts shall be one and 1-1/2 inch.

Pour a concrete header with the top edge flush with the top surface of the concrete blocks. The bottom shall extend below the concrete blocks as noted on the AML Standard Detail. After the subgrade is prepared construct a compacted base using dense grade aggregate compacted to minimum 90% proctor.

The entire perimeter of the cellular block system shall be turned and buried beneath the adjacent ground level to a depth of not less than 3 feet or as shown on the drawings.

CONCRETE BLOCK - TIED MAT

1. SCOPE

The work shall consist of furnishing and installing tied concrete block mat where shown on the Drawings or as otherwise directed by the ENGINEER.

2. MATERIALS

2.1. **Type I Units**: These units shall be concrete blocks cast around a bi-axial geo-grid product.

2.2. **Type II Units**: These units shall be concrete blocks tied together with steel cables.

2.3 **Concrete**: The unit weight of the concrete used shall not be less than 125 pounds per cubic foot on an oven dried basis. Pre-cast concrete and machine made blocks shall have a three block average compressive strength of 4,000 psi with no blocks less than 3,500 psi strength in testing. Use 2 inch long fibers weighing one-pound per cubic yard of concrete. Machine made concrete blocks strength shall be determined by testing random cubes, cut from the body of the block.

2.4. **Geogrid**: Shall be a high-strength bi-axial geo-grid product of the same strength parameters of the block unit material.

2.5. **Ties**: Shall be commercially available heavy duty zip ties.

2.6. **Anchor stakes**: Shall be either "U" shaped anchors or bent rebar.

<u>COMPONENT</u>	<u>PROPERTY</u>	<u>MIN. VALUES</u>
Block	Block Size	5" x 5" (L x W) 2" thickness
	Block Weigh	3.0 lbs
	Shape	Pyramid rectangular
	Block Ground Cover	75%
	Concrete	4,000 psi
Geo-grid	Tensile Strength	800 lbs/ft Machine Direction
		800 lbs/ft Cross Direction
Under mat	Straw Coverage Rate	12 oz/sy

3. CONSTRUCTION

Grade channel so that water will flow down the center of the channel and be contained to the channel. All subgrade surfaces prepared for placement of mats shall be smooth and free of all

rocks, sticks, roots, other protrusions, or debris of any kind. The prepared surface shall provide a firm unyielding foundation for the mats with no sharp or abrupt breaks in the grade. Apply seed directly to the prepared soil prior to mat installation.

Type I Units:

Embed the initial leading edge of the ditch in a trench 18 inches deep by 2 feet wide by the ditch width and backfill the trench with grout or concrete (min. 3,500 psi). Lay down mat and pull back edges, lay geo-grid mat and then relay block mat on geo-grid. This method prevents tearing the underlying geo-grid mat. Connect mat sections with seams perpendicular to the water flow via a geo-grid seam. Longitudinal joints do not require connecting. Tie mats to the geo-grid using heavy duty ties consisting of 1/4 inch heavy duty zip ties set on 1 foot increment across the seam. The ENGINEER may elect to add "U" shaped rebar anchors (incidental) set a minimum of 2 feet deep. The ENGINEER may require intermediate concrete/grout anchors.

Type II Units:

Buttress the leading edge against a concrete header 18" inches deep by 2 feet wide by the ditch width and backfill the trench with grout or Class A concrete (min. 3,500 psi). Install the mats per manufacturer recommendations.

UNIT NO.	DESCRIPTION	AMOUNT
1	18" x 24" x 18" CONCRETE BLOCK	100
2	18" x 24" x 18" CONCRETE BLOCK	100
3	18" x 24" x 18" CONCRETE BLOCK	100
4	18" x 24" x 18" CONCRETE BLOCK	100
5	18" x 24" x 18" CONCRETE BLOCK	100
6	18" x 24" x 18" CONCRETE BLOCK	100
7	18" x 24" x 18" CONCRETE BLOCK	100
8	18" x 24" x 18" CONCRETE BLOCK	100
9	18" x 24" x 18" CONCRETE BLOCK	100
10	18" x 24" x 18" CONCRETE BLOCK	100

DITCHES

1. SCOPE

This item consists of the construction of ditches (and channels) to the lines and grades depicted in the final cross-sections and Drawings. Lining materials shall meet the requirements of related sections of these Technical Specifications. Excavated rock ditches shall be constructed in accordance with details included in the plans.

2. MATERIALS

2.1. **Erosion Control Blanket (ECB)**: Shall conform to the “Erosion Control Blanket” technical specification.

2.2. **Rock Aggregate**: Shall conform to the “Crushed Aggregate and Channel Lining” technical specification.

2.3. **Tied Concrete Block Mat**: Shall conform to the “Concrete Block Mat- Tied” technical specification.

2.4. **Gabion**: Shall conform to the “Gabion” technical specification.

2.5. **Concrete**: Shall conform to the “Concrete” technical specification.

2.6. **Filter Fabric**: Shall conform to the “Filter Fabric” technical specification.

2.7. **Revegetation Materials**: Shall conform to the “Revegetation” technical specification.

2.8. **Bales**: Shall conform to the “Silt Control” technical specification.

2.9. **Silt Fence**: Shall conform to the “Silt Control” technical specification.

2.10. **Steel**: Shall conform to the “Steel” technical specification.

2.11. **Vehicular Grates**: Shall be equivalent of Hoe of KY Type A with embedded rail frame.

2.12. **Non-Vehicular Grates**: Shall be 1” x 3/16” bearing bar black painted welded steel bar grating.

3. CONSTRUCTION

3.1. **Subgrade Preparation**: The subgrade surfaces on which filter fabric, and/or rock are to be placed shall be graded to the lines and grades shown on the Drawings and AML Standard Details. Filter fabric shall not be placed until the foundation and the subgrade surfaces have been prepared, inspected, and approved by the ENGINEER. Geo-grid may be used under

ditches instead of filter fabric (see Standard Details and Drawings). Do not use geo-grid or filter fabric under ditches greater than 10% slope.

3.2. Rock Aggregate Placement: Place and shape filter fabric or geo-grid under ditches less than 10% slope or as directed by the ENGINEER, AML Standard Details, and/or Drawings. The channel lining shall be carefully placed by hand or by equipment to the depths specified on the Drawings. The lining shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials and damage to the underlying filter fabric. The rock shall be delivered and placed in a manner that will ensure that the lining, in-place, shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another, and with the smaller rocks and spalls filling the voids between the larger rocks.

Where encountering solid rock, end the slope protection at the solid rock line as shown on the Drawings or as directed by the Engineer.

3.3. Tied Concrete Block Mat: Prior to placing the tied concrete mat, prepare the sub grade area by clearing all rocks and debris 3 inches or larger. Apply seed directly to the prepared soil prior to installation of the tied concrete block mat.

Install mats to the line and grade shown on the plans, AML Standard Details, and in accordance with the manufactures installation guidelines. The manufacture shall provide technical assistance during the slope preparation and installation of the flexible channel lining.

3.4. Gabion Lined Ditches: Place and shape filter fabric or geo-grid under ditches less than 10% slope or as directed by the ENGINEER, AML Standard Details, and/or Drawings. Gabion ditches include gabion anchors and concrete cutoff end treatments.

3.5. Concrete Lined Ditches: Shall be constructed to the shape and dimensions indicated on the Drawings, AML Standard or as directed by the ENGINEER. For concrete trenches requiring grates use either the vehicular or non-vehicular grate type with a steel anchor plate. Secure & anchor the grates as shown in the AML Standard Details.

3.6. Excavated Rock Ditches: Excavated Rock Ditches shall be constructed at locations shown on the plans or as directed by the ENGINEER. Excavated Rock Ditches shall be considered incidental to Earthwork if natural swales in "excavated to rock areas" exist and no additional work is required. If extremely hard rock is encountered, then a hoe ram shall be utilized to construct the ditches. The CONTRACTOR may utilize alternative equipment with the approval of the ENGINEER.

EROSION CONTROL BLANKET

1. SCOPE

The work shall consist of placing erosion control blankets in ditches and on slopes as indicated on the Drawings or as directed by the ENGINEER.

2. MATERIALS

2.1. Type A: Shall be made from straw fibers set between a top and bottom layer of UV-stable polypropylene netting. Materials must have a maximum allowable velocity of at least 5.5 feet per second and allowable shear stress of at least 1.7 pounds per square foot. Products should have an effective lifespan of 1-2 years.

2.2. Type B: Shall be made from curled wood fibers set between a top and bottom layer of UV-stable polypropylene netting. Materials must have a maximum allowable velocity at least 5.5 feet per second and allowable shear stress at least 2.0 pounds per square foot. Products should have an effective lifespan of 1-2 years.

2.3. Type C: Shall be made from a mixture of 70% straw & 30% coconut fibers set between a top and bottom layer of UV-stable polypropylene netting. Material must have a maximum allowable velocity of at least 8 feet per second and allowable shear stress of at least 2 pounds per square foot. Products should have an effective lifespan of 1-2 years.

2.4. Fasteners: Fasteners shall be either steel staples or wooden stakes. Staples must be "U" or "T" shaped steel wire having a minimum gauge of No. 11 and No. 8 respectively. "U" shaped staples must average 1 to 1-1/2 inch wide and be a minimum of 6 inch long. "T" shaped staples must have a minimum 8 inch main leg, a minimum 1 inch secondary leg, and minimum 4 inch head. Wooden stakes must be rough-sawn hardwood, 12-24 inches in length, 1 inch by 3 inches in cross section, and wedge shaped at the bottom.

2.5. Coir: Shall be a natural woven geotextile fabric spun from natural coir fiber meeting or exceeding the following:

Property	Test Method	Typical Values		
		MD	XD	
Mass per Unit Area	ASTM D-6475	18		oz/yd ²
Thickness	ASTM D-6525	396		mils
Light Penetration	ASTM D-6567	36		%
Ground Cover	ASTM D-6241	64		%
Tensile Strength	ASTM D-6818	102	75	Lbs/in
Elongation	ASTM D-6818	45	40	%

3. CONSTRUCTION

Prepare the subgrade including removing all debris, roots, rocks, or other objects that will prevent a tight soil to mat contact, and then seed the area in accordance with the "Revegetation" section of the Technical Specifications before placement of the blanket.

Unroll the blankets in the direction of water flow. When using two blankets side by side, the seams shall not be placed in the center of the ditch, but shall be offset by 1 foot. Secure blankets in a staggered pattern on 4 foot (maximum) centers throughout and 2 foot (maximum) centers along seams, joints, and roll ends, unless the manufacturer recommends a tighter spacing. When blankets are laid side by side, insert staples to anchor the edge of each roll. Overlap of blankets in accordance with the manufacturer's recommendations.

Typical application of Type A blankets is in diversion ditches, along the upper edges of rock ditches, and on slopes up to 2:1.

Typical application of Type B blankets is in EKY ECB swale and ECB flat bottom ditches and on slopes between 2:1 and 1.5:1.

Typical application of Type C blankets is in EKY & WKY ECB swale and ECB flat bottom ditches and on slopes up to 2:1.

Stake coir fabrics with wooden stakes at least 18 inches long or metal pins on 3 foot spacing (3 per square yard of fabric) driven until all but a 1 inch crown is in the ground. Overlap the fabric at least 18 inches in the water flow direction.

NON-REINFORCED CONCRETE BLOCK WALLS

1. SCOPE

Work includes furnishing and installing concrete retaining wall units to the lines and grades designated on the Drawings and as directed by the ENGINEER.

2. MATERIALS

2.1. Type I Wall Units: Shall be a Keystone material, or an approved equivalent. All walls must conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units and the following:

Minimum Structural, Geometric, Construction Requirements	
Compressive Strength	3,500 psi
Unit Size	8" H x 18" W x 18" D \pm 1/8 inch
Unit Weight	100 lbs/unit

The walls shall have a vertical setback between 1/8 inch and 1 inch per course. The alignment and grid positioning mechanism is with fiberglass pins set at a minimum of two per unit minimum. The maximum horizontal gap between erected units shall be less than or equal to 1/2 inch.

2.2. Type I Wall Shear Connectors: Shear connectors shall be 1/2 inch diameter thermoset isophthalic polyester resin-pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10°F to 100°F. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.3. Type II Wall Units: Shall be as manufactured by Redi-Rock or an approved equivalent. The type of wall units used shall be approved by the ENGINEER before construction is allowed to begin.

2.3.1. Concrete: Shall have minimum 28 day compressive strength of 4,000 PSI

2.3.2. Shear Knobs: Shall have a height of 4 inch minimum and 8 inch minimum diameter and be set approximately 1/2 the length of the block and at least 6 inches from the edges for full size blocks. Knobs must be 6" diameter for corner blocks.

2.3.3. Sizes:

Full size blocks- 18 inches tall x 46 inches wide x 28 inches, 41 inches, or 60 inches deep

Half size blocks- 18 inches tall x 23 inches wide x 28 inches, 41 inches, or 60 inches deep

Corner blocks- 18 inches tall x 46 inches wide x 24 inches deep

2.4. **Aggregate Backfill**: Shall conform to the “Crushed Aggregate and Channel Lining” technical specification.

2.5. **Pipes**: Shall conform to the “Pipe” technical specification.

2.6. **Concrete**: Shall be Class “AA” concrete conforming to the “Concrete” technical specification.

2.7. **Steel Reinforcement**: Shall be 60 KSI steel conforming to the “Steel” technical specification.

2.8. **Geo-grid**: Shall be a bi-axial product conforming to the “Geo-grid” technical specification.

3. **CONSTRUCTION**

Check the materials upon delivery to assure proper material has been received and shall protect the materials from damage. Damaged material shall not be incorporated in the project. Prevent excessive mud, wet cement, and like materials from coming in contact with the units.

Excavate to the lines and grades shown on the Drawings. Construct the reinforced concrete footer on undisturbed soil unless the ENGINEER requires a geo-grid and crushed aggregate pad prior to concrete placement. The pad must cure for a minimum of 7 days before placing any block on the footer. For steps and pavers, a minimum of one to 1-1/2 inches of free draining sand shall be screed smooth to act as a placement bed for the steps or pavers.

All walls should terminate into the existing ground either due to winged ends or 90° corners.

3.1. **Type I Wall Unit Installation**:

3.1.1. **Blocks**: Place the first course of units on the footer at the appropriate line and grade. Check the alignment and level in all directions and insure that all units are in full contact with the base and properly seated. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with the manufacturer's recommendations. Install shear/connecting devices per manufacturer's recommendations. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.1.2. **Structural Geo-grid Installation**: Orient uni-axial geo-grid shall be oriented with the highest strength axis perpendicular to the wall alignment. Place the geo-grid horizontally on compacted backfill and attach to the modular wall units. Insert fiberglass rods into the blocks. Place the next course of modular concrete units over the geo-grid. Pull the geo-grid taut and anchor prior to backfill placement on the geo-grid. Geo-grid reinforcements shall be continuous

throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geo-grid or gaps between adjacent pieces of geo-grid are not permitted.

3.1.3. Reinforced Backfill Placement: Place, spread, and compact reinforced backfill in lifts not to exceed 6 inches where hand compaction is used or 8-10 inches where heavy compaction equipment is used. Compact reinforced backfill to 95% proctor. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail of the modular concrete unit. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided. At the end of each day's operation, slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. Do not allow surface runoff from adjacent areas to enter the wall construction site.

3.1.4. Cap Installation: Glue cap units to underlying units with an all-weather adhesive recommended by the manufacturer.

3.2. Type II Wall Unit Installation

3.2.1. Blocks: Place the first course of units on the footer at the appropriate line and grade. Check the alignment and level in all directions and insure that all units are in full contact with the base and properly seated. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with the manufacturer's recommendations. Install shear/connecting devices per manufacturer's recommendations. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

Grind smooth any rough edges on the back of the concrete blocks prior to placement to avoid damage to the geogrid under tension.

3.2.2. Structural Geo-grid Installation: For any 21 inch block wall with heights greater than 15 feet or any 21 inch block wall regardless of wall height that will have constant additional surcharge loadings applied behind it, the contractor will be required to install geo-grid and make proper connection to the retaining wall blocks for reinforced soil walls. For 41 inch or 60 inch block walls, geo-grid may not be needed. Always check final plan design for these types of walls to see if geo-grid will be used. Place the bi-axial geo-grid perpendicular to the wall. Place the next course of modular concrete units over the geo-grid. Pull the geo-grid taut and anchor prior to backfill placement on the geo-grid. Geo-grid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geo-grid or gaps between adjacent pieces of geo-

grid are not permitted.

Geo-grid placement on corners shall follow the procedures outlined in the Design Manual for Segmental Retaining Walls, Second Edition, Copyright 1997, National Concrete Masonry Association, Herndon, VA. See the following details or convex and concave curve corners.

3.2.3. Reinforced Backfill Placement: Place, spread, and compact reinforced backfill in lifts not to exceed 6 inches where hand compaction is used or 8-10 inches where heavy compaction equipment is used. Compact reinforced backfill to 95% proctor. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer. Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail of the modular concrete unit. Tracked construction equipment shall not be operated directly upon the geo-grid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geo-grid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geo-grid. At the end of each day's operation, slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. Do not allow surface runoff from adjacent areas to enter the wall construction site.

PIPE

1. SCOPE

This work shall consist of furnishing and installing drainage pipe at the locations shown on the drawings or as directed by the Engineer, including all necessary fittings and backfilling.

2. MATERIALS

2.1. Corrugated Metal Pipe (CMP): All corrugated metal pipe shall conform to the requirements of AASHTO M 36. Pipe shall have welded seams with helical corrugations having a pitch of two and 2-2/3 inches and a depth of 1/2 inch. The minimum metal thickness of the pipes shall be 14-gauge for 24 inch diameter or less and 12-gauge for 36 inch and greater diameter, **unless fill heights dictate a different gauge according to the AML Standard Details pipe fill charts.**

2.2. CMP Connections: The connections between sections of pipe and end treatments shall be made with coupling bands or other mechanisms of durability equal to or greater than the pipe. Coupling bands shall meet the requirements of AASHTO M-36.

2.3. CMP Coatings: Any damage to the coating shall be repaired by thoroughly wire brushing the damaged area, removing all loose and cracked coating, removing all dirt and greasy material with solvent, and painting with two coats of material. If the coating is damaged in any individual area larger than 12 square inches, or if more than 0.2% of the total surface area of a length of pipe is damaged, the length will be rejected.

2.3.1. Zinc Coating: The repair coating shall be a zinc dust-zinc oxide primer or equivalent as specified by the manufacturer.

2.3.2. Bituminous Coatings: All BCCMP pipe shall be fully bituminous coated in accordance with AASHTO M-190. Breaks and scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by the application of two coats of hot asphaltic paint or a coating of cold applied bituminous mastic. The repair coating shall be at least 0.05 inches thick after hardening and bonded securely and permanently to the pipe. Whenever individual breaks exceed 36 square inches of area or when the total area of breaks exceed 0.5% of the total surface area of the pipe, whichever is less, the pipe will be rejected.

2.4. Reinforced Concrete Pipe (RCP): The drainage pipe shall be Class III RCP **unless fill heights dictate a different class according to the AML Standard Details pipe fill charts.** The pipe can be circular or non-circular and the length as indicated on the Drawings or as directed by the ENGINEER. **RCP WILL BE USED UNDER ALL PAVED ROADS WITH FLOWABLE FILL.**

2.5. High Density Polyethylene Pipe (HDPE): The drainage pipe shall be made of virgin high density polyethylene compounds which conform to the requirements of Type III, Category 4, 5, Grade P30, or P34 Class C per ASTM D-128. HDPE and pipe shapes shall meet the

requirements of ASTM F405, ASTM F667 AASHTO M-294-85I; ASTM D-2122 with minimum 20 foot lengths. All HDPE pipe will be dual wall pipe meaning a corrugated exterior and smooth interior unless approved in writing otherwise by the ENGINEER.

2.6. Reinforced High Density Polyethylene Pipe (RHDPE): Shall be made from virgin high density polyethylene compounds and ribbing reinforcement manufactured using a high quality stress-rated thermoplastic meeting the requirements of ASTM F2562 "Standard Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage" or AASHTO Designation MP-20, Bridge Construction Section 26 & Design Section 12.

2.7. HDPE & RHDPE Connections: Corrugated fittings may be either molded or fabricated by the manufacturer. The use of fittings supplied by the manufactures other than the supplier of the pipe shall not be permitted without the approval of the ENGINEER.

Couplings shall be corrugated to match the pipe corrugations and the width shall not be less than half the nominal diameter of the pipe, split couplings shall be manufactured to engage an equal number of corrugations on each side of the pipe joint. Where required by the ENGINEER, a mastic type gasket or other gasket acceptable to the ENGINEER may be used.

2.8. Polyvinyl Chloride (PVC) Pipe: PVC pipe and fittings shall be Schedule 40 meeting the requirements of ASTM D-1785.

The PVC pipe shall be delivered to the job site and handled by means, which provide adequate support to the pipe and do not subject it to undue stresses or damage. When handling and placing the PVC pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal surfaces or rocks). All special handling requirements of the manufacturer shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at temperatures of 40°F or less.

The PVC pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specially manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for a period of fifteen days or longer.

All fittings and appurtenances for the PVC pipe shall be manufactured and furnished by the pipe supplier and have bell and spigot configurations compatible with that of the pipe. All solvent cement joints for PVC pipe and fittings shall be made in accordance with ASTM D-2855 for PVC pipe and fittings.

All connections between the pipe and flanges on valves shall be according to the manufacturer's recommendations and approved by the ENGINEER.

2.9. Aggregate Backfill: Shall conform to the "Crushed Aggregate and Channel Lining" technical specification.

2.10. Flowable Fill Backfill: Shall conform to the "Grout Products" technical specification.

3. CONSTRUCTION

Exercise care in all operations, such as placing the pipe, jointing, bedding and backfilling. It shall be the CONTRACTOR'S responsibility to see that pipes are not damaged during unloading or placement, during compaction of the backfill by movement of excessively heavy equipment over the backfill, or by any other forces that may cause damage.

Excavate trenches for pipes to the lines and grades shown on the Drawings. The trench shall be dry and unfrozen at the time the pipe is installed. Make soft and/or hard spots as uniform as practical with sand, gravel, crushed stone, or other suitable material to ensure even settlement of the pipe. Lay the outside laps of circumferential joints point upstream, with no longitudinal joints in the lower quadrant. Place backfill in layers not exceeding 6 inches loose thickness for hand operated machine compactors and 8 inches loose thickness for other compaction methods, unless otherwise specified. Fill material shall be free from organic material, stumps, large rocks, hard lumps, or clods larger than 3 inches in diameter. Sod, cinders, and frozen fill will not be allowed. Hand tampers for compacting horizontal layers should weigh not less than 20 pounds and have a maximum face of 6 x 6 inches. Sheepsfoot and rubber-tired tamping rollers can be used to compact backfill around the pipe **provided they will not cause damage to the pipe. Power tampers and rollers must not contact the pipe. Fill adjacent to the pipe must be hand or mechanically tamped.** Bring the backfill up evenly on both sides of pipe for the full length of the pipe. Backfill the remainder of the trench with crushed aggregate. Use special materials for roadways as designated on the Drawings or provided in writing by the ENGINEER. Remove and relay pipe that is not in true alignment or which shows abnormal settlement after placement.

Anchor pipes (especially HDPE & RHDPE pipe) before using flowable fill, in accordance with these Technical Specifications. Failure to properly anchor pipes where they are in not proper alignment or grade in accordance with the Drawings shall result in the CONTRACTOR removing the pipe and relaying the pipe to the proper alignment and grade.

All pipe placed without the use of a headwall or any type of anchor shall be flush with the slope, where the water flowing out of the pipe will not create a condition that will cause the pipe to be undercut.

Complete the installation of the pipe (including excavation, backfill, and temporary traffic base) in one day and coordinated beforehand with local residents. All necessary arrangements are the responsibility of the CONTRACTOR, subject to the ENGINEER'S approval. **The Drawings may specify that the construction not interrupt the flow of traffic. In that case the ENGINEER must pre-approve a traffic flow plan prior roadway disturbance.**

SHEET PILING

1. SCOPE

This section describes the types of steel sheet piling used during construction. The actual size and placement of the products are noted on the Drawings and/or as directed by the ENGINEER.

2. MATERIALS

Steel shall be kept free from dirt, grease and other foreign matter, and shall be protected from corrosion.

2.1. Sheet Piling: Shall be made in accordance with ASTM A 857 from steel meeting the requirements of ASTM A 1011, Grade 30. The sides of each piece of sheeting shall be furnished with an interlock that is continuous for the full length of the sheeting. The interlock shall have an opening of sufficient width to allow free slippage of the adjoining sheet.

2.2. Galvanized Coating: When required, the sheeting shall be hot-dipped galvanized per ASTM A 123 at a rate of two ounces per square foot total both sides.

3. CONSTRUCTION

Install the piling per the manufacturer recommendations and as directed by the ENGINEER. Sheet Piling shall be driven by equipment recommended by the manufacturer. Damage to sheet piling as a result from improper driving equipment may result in the COMMONWEALTH refusal to pay for the damaged sheet piling.

SUBSURFACE DRAINS

1. SCOPE

The work shall consist of furnishing all labor, materials (including rock backfill, sand, filter fabric, and pipe), equipment, and incidentals for the construction of the subsurface drains shown on the Drawings or other areas designated by the ENGINEER.

2. MATERIALS

2.1. Pipe: The tubing shall be 8 inch diameter, dual wall, and smooth interior high density polyethylene (HDPE) pipe. All caps, bands, and other fittings shall be made of the same material as the tubing. All pipe-to-pipe connections shall be snap-in-place bands or a split band taped in place with polyethylene tape to the satisfaction of the ENGINEER. Remote ends shall be capped with a snap-in-place cap.

The ENGINEER or Drawings may call for a large size pipe (incidental).

2.2. Filter Fabric: The filter fabric shall conform to the requirements of the "Filter Fabric" technical specification.

2.3. Course Aggregate: The drain fill shall be a No. 2 and No. 57 aggregate and conform to the requirements of the "Crushed Aggregate and Channel Lining" technical specification.

2.4. Non-calcareous Aggregate: Shall be washed river gravel (not limestone) or granite rock conforming to the appropriate size material shown on the AML Standard Details and "Crushed Aggregate & Channel Lining" technical specification. This material is for drains collecting iron laden waters.

2.5. Subdrain Collars: These shall be Class A concrete conforming to the "Concrete" technical specification.

2.6. Coupling Bands: Provide coupling bands recommended by the manufacturer.

3. CONSTRUCTION

3.1. Subdrain: Excavate the trench to a depth below the outside bottom of the plan subsurface drain elevation to allow for the placement of sufficient bedding eliminating any irregularities in the trench bottom, and to a width of at least one foot wider than the external diameter of the pipe. Place perforated pipe with the perforations in the invert. Subsurface drains shall have a **minimum slope of 1%** unless specified otherwise. Close the upgrade ends of all subsurface drain pipes with plugs to prevent entry of debris. Equip the outlet end of subsurface drain pipe with a screen. Join perforated sections with coupling fittings or bands. Place and compact granular backfill of Size No. 2 or No. 57 aggregate around the pipe ensuring that the pipe is true to line and grade and the haunches are fully supported.

When drains are greater than 5 feet in depth they shall use “sock-pipe”.

In areas where the subdrains are not designed to pick up ground water but are designed to transfer the water to a defined channel the pipe in that portion of subdrain shall be solid pipe and non-perforated. Set a subdrain collar at the junction of the perforated and non-perforated pipe.

Sheeting and bracing, or other structural and/or special construction techniques, must be utilized, if necessary, for safety reasons.

3.2. Rock Core Drains: The Drawings will specify if native stone may be used in the central drain. If not stated, then limestone must be used in the drain as shown on the AML Standard Details.

3.3. Rock Toe Buttresses: The ENGINEER will specify if native stone may be used in the drains. If not stated, then limestone aggregate must be used in the drain as shown on the AML Standard Details.

TEMPORARY LOW WATER CROSSING

1. SCOPE

This work shall consist of constructing, maintaining, removing (temporary and permanent) a temporary low water crossing at locations depicted on the Drawings for the safe passage equipment and materials.

2. MATERIALS

2.1. Course Aggregate: Shall conform to the “Crushed Aggregate and Channel Lining” technical specification.

2.2. Pipe: Shall conform to the “Pipe” technical specification.

2.3. Concrete: Shall be Class A concrete conforming to the “Concrete” technical specification.

3. CONSTRUCTION

Construct the crossing with a maximum fill height of 4-1/2 feet measured from the channel bottom to the top of the proposed crossing. Lay pipes flush with the bottom of the stream channel using pipes **no be less than** 24-36 inch diameter set no more than 1 foot spacing between the pipes. Place as many pipe as possible shall be placed within the stream banks. Place clean rock or concrete as fill material no greater than 18 inches.

Regularly inspect and maintain the crossing including the approaches, aggregate cover, bedding, and pipes. Keep the pipe(s) clean to ensure maximum hydraulic capacity during the project duration. Any failing pipe shall be removed and replaced.

The ENGINEER may require the removal of the crossing due to significant storm events. The removal, reinstallation, and repair are incidental to the overall crossing installation.

At the completion of the project, completely remove the crossing (concrete, aggregate, and pipes) and return all disturbed areas to preexisting conditions (i.e. existing topography configuration of area in and around the low water crossing area) and vegetated.

WETLAND COMPOST

1. SCOPE

This work shall consist of furnishing, mixing, and placing a wetland compost mixture for bedding within wetland cells.

2. MATERIALS

2.1. **Hardwood Bark Mulch**: Shall conform to the "Revegetation" technical specification.

2.2. **Limestone Sand**: Shall conform to the "Revegetation" technical specification.

2.3. **Straw and Hay Mulch**: Shall be a 1:1 mixture of material conforming to the "Revegetation" technical specification.

2.4. **Compost/Manure**: Shall consist of three parts by volume carbon based material such as straw, hay, corn stalks, leaves and/or wood chips and one part by volume of nitrogen based materials such as grass clippings, green silage, green haylage, or other similar materials approved by the ENGINEER. The temperature during composting shall remain between 105 °F and 145 °F. The compost shall result in a dark brown or black, humic material in which the initial constituents are no longer recognizable and further degradation is not noticeable. Heavy metal, organic chemical and pathogen concentrations of the compost shall be within the limits established by federal and state environmental regulations. A representative sample shall be tested for the above to ensure compliance. Material shall not contain more than 40% moisture by weight. The product may be damp but should not drip when squeezed. Compost shall have an earthy smell when wetted and placed in a sealed plastic bag after 72 hours. The finished compost shall not heat when stacked in a pile.

3. CONSTRUCTION

The aforementioned material will be combined to create an organic substrate. The homogeneous mixture will be made from the approximate percentages:

Component	Volume (CYD)	Weight (TON)
Hardwood Bark Mulch	30%	13%
Limestone Sand	10%	59%
Straw and Hay (1:1 Mixture)	50%	20%
Compost/manure	10%	8%

Blend the above ingredients into a uniform consistency. Wet the materials before blending lime and compost into the mixture. Place the mixture with truck end dump or excavator. Minimize compaction including minimizing foot traffic across placed substrate.

